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Research paper

Characterization of Some Selected Morphometric and Meristic Features of Commonly Occurring Fish Species from Mirkarwada Landing Centre, Ratnagiri

Simran Bhatkar [1], **Zubeda Hodekar** [1], **Mohini Bamane** [1], **Madhura Mukadam*** [1]

[1] *Department of Zoology, Gogate Jogalekar College, Ratnagiri 415612 (MS), India*

KEYWORDS

Morphometric traits
Meristic analysis
Marine biodiversity
Condition factor

ABSTRACT

This study investigates the morphometric and meristic traits of six commercially important fish species from the Mirkarwada Fish Landing Centre, located along the Konkan coast of Maharashtra. Morphometric data (such as length and weight) and meristic traits (such as fin ray counts and scale types) were analyzed to assess the ecological health and biological fitness of these species. Notable species-specific variations were observed in both traits, including the high meristic counts in *Solea solea* (Sole fish) and the exceptional condition factor (K) of *Parasatromateus niger* (Black Pomfret), which reflects its ecological fitness. This study underscores the significance of morphometric and meristic studies in promoting sustainable fisheries management and biodiversity conservation.

1. Introduction

Morphometric and meristic analyses are fundamental tools in fisheries biology, offering insights into the physical and numerical characteristics of fish species. These methods are critical for taxonomic classification, assessing growth patterns, habitat conditions, and overall health, as well as understanding population variations across different geographic regions (Jisr *et al*., 2018; Hassan *et al.,* 2020). Morphometric studies focus on physical measurements of fish, such as body length and weight, while meristic analyses deal with countable traits, such as fin rays and scales. Together, these approaches are invaluable for identifying species, distinguishing populations within the same species, and understanding their ecological roles (Ambily, 2017; Khatun *et al*., 2021).

The importance of these analyses extends beyond basic taxonomy, serving as a foundation for studies in evolutionary biology and biodiversity monitoring. Although DNA sequencing has become a popular tool for investigating evolutionary relationships among taxonomic groups, its high cost often limits its application. Morphometric and meristic studies, being cost-effective and widely accessible, remain a preferred method for routine fisheries research (Masood *et al*., 2015). Additionally, such studies are crucial for supporting sustainable fisheries management, providing data on population health, growth patterns, and habitat utilization (Langer *et al*., 2013; Sabbir *et al*., 2020).

Ratnagiri, located along the Arabian Sea in Maharashtra, is renowned for its marine biodiversity and significant contributions to the regional economy through fisheries. However, despite its ecological and economic

***Corresponding author**: Madhura Mukadam

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importance, there is a paucity of research on the morphometric and meristic characteristics of fish species commonly found in this area. This study focuses on six commercially and ecologically significant fish species from the Mirkarwada landing center: *Solea solea* (Sole Fish), *Lacterius lacterius* (False Trevally), *Rastrelliger kanagurta* (Indian Mackerel), *Gerres macracanthus* (Gerres), *Parasatromateus niger* (Black Pomfret), and *Pampus argenteus* (Silver Pomfret).

By analyzing the morphometric and meristic traits of these species, this research aims to enhance our understanding of their taxonomic classification, ecological roles, and health status. The findings will contribute to biodiversity monitoring, sustainable fisheries management, and the conservation of marine resources in the Ratnagiri region. This study also provides a foundation for future research on the evolutionary relationships and ecological dynamics of fish species in this biodiversity-rich area.

2. Materials and Methods

2.1 Study Area

The study was conducted at the Mirkarwada Fish Landing Centre (16°59’ N, 73°18’ E) in Ratnagiri, Maharashtra. Situated along the Konkan coast, this region is characterized by its tropical climate and nutrient-rich waters, which support a diverse range of fish species.

2.2 Sample Collection

A total of 30 specimens representing six species (*Solea solea, Lacterius lacterius, Rastrelliger kanagurta, Gerres macracanthus, Parasatromateus niger, Pampus argenteus*) were collected from the Mirkarwada Fish Landing Centre. The specimens were transported to the laboratory and preserved in 10% formalin for subsequent analysis. Morphometric measurements were obtained using a digital calliper, while meristic counts were performed using a magnifying lens.

2.3 Morphometric and Meristic Measurements

Two key categories of data were recorded for the fish species:

1. Morphometric Properties:
    - Length: Total length (cm) of each fish.
    - Weight: Body weight (g) of each fish.
    - Condition Factor (K): Calculated using the formula:

$K = (W / L^3) \times 100$

where W represents weight in grams and L is the total length in centimeters.

2. Meristic Properties:
    - Fin Ray Counts: Dorsal, caudal, anal, pelvic, and pectoral fin rays were counted.
    - Scale Types: Scales were classified as either cycloid or ctenoid.

All measurements and counts were conducted in the laboratory following the methods described by Day (Day 1889, Talwar & Jhingran,1991 and Jayaram 2020). Morphometric parameters were measured in centimeters (cm), and weights were recorded in grams (g).

3. Results

In this investigation, six species were identified i.e., *Solea solea* (Linnaeus 1758) under order Pleuronectiformes and family Soleidae, *Lacterius lacterius* (Bloch & Schneider 1801) under order Perciformes and family Lactariidae, *Rastrelliger kanagurta* (Cuvier 1816) under order Scombriformes and family Scombridae, *Gerres macracanthus* (Bleeker 1854) under order Perciformes and family Gerreidae, *Parasatromateus niger* (Bloch 1795) under order Carangiformes and family Carangidae and *Pampus argenteus* (Euphrasen 1788) under Stromateiformes and family Stromateidae. The morphometric and meristic data for these species was summarized in Table 1.

Total length and Body weight are taken as Morphometric characters and Dorsal fin rays, Pectoral fin rays, Pelvic fin rays, Anal fin rays and Caudal fin rays are taken as meristic characters. Condition factor was calculated to assess the health and well-being of the fish based on weight and length.

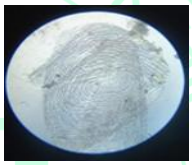
Table 1 Morphometric and Meristic Characteristics of the Identified Fish Species

Fish Species	Length (cm)	Weight (gm)	Types of scales	Caudal fin rays	Anal fin rays	Pectoral fin rays	Pelvic fin rays	Dorsal Fin rays	Condition factor
Sole Fish (*Solea solea*)	14.7	14.59	Dorsal side – Ctenoid Abdominal side - Cycloid	10	48	7	5	65	0.45 (Poor health)
False Trevally (*Lacterius lacterius*)	16.3	45.83	Ctenoid	16	21	14	6	28	1.05 (Average health)
Indian Mackerel (*Rastrelliger kanagurta*)	20.3	100.37	Cycloid	19	14	21	7	20	1.19 (Good health)
Gerres *(Gerres macracanthus)*	16.3	66.12	Cycloid	17	10	16	6	19	1.52 (Good health)
Black Pomfret (*Parasatromateus niger*)	16.0	88.05	Cycloid	17	28	21	6	37	2.14 (Very good health)
Silver Pomfret (*Pampus argenteus*)	19.1	104.46	Cycloid	18	29	19	6	31	1.49 (Good health)

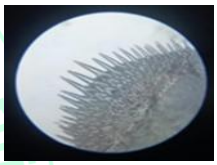
1) *Solea solea* (Sole Fish)

Abdominal Side

Dorsal side

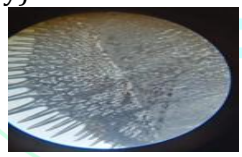


Cycloid Scales (Abdominal Side)

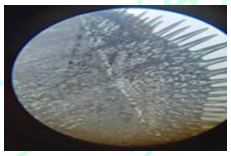


Ctenoid scales (Dorsal side)

2) *Lacterius lacterius* (False Trevally)

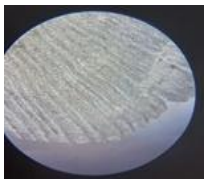


Ctenoid scales (Gill Region)



Ctenoid scales (Tail Region)

3) *Rastrelliger kanagurta* (Indian Mackerel)

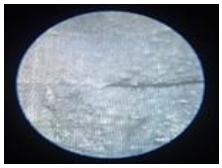


Cycloid Scales

Cymothoa exigua (Parasite- Found in gills)

4) *Gerres sp.*

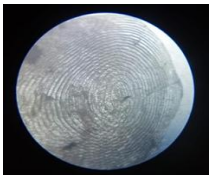
Cycloid Scales (Gill Region)



Cycloid Scales (Tail Region)

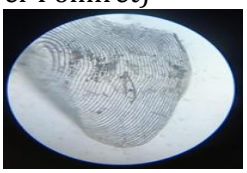
5) *Parasatromateus niger* (Black Pomfret)

Cycloid Scales (Gill region)

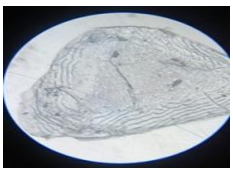


Cycloid Scales (Tail Region)

6) *Pampus argenteus* (Siver Pomfret)



Cycloid Scales (Gill region)



Cycloid Scales (Tail Region)

3.2 Scale Types and Fin Ray Counts

- *Solea solea*: Exhibits a combination of ctenoid scales on the dorsal side and cycloid scales on the abdominal side, with a low number of fin rays, which is typical for benthic species.
- *Lacterius lacterius*: Exhibits ctenoid scales in both the gill region and tail region. This species has a moderate number of fin rays, reflecting its adaptation to an active pelagic environment.
- *Rastrelliger kanagurta*: Cycloid scales dominate in the species, which is characteristic of fast-swimming species. The presence of *Cymothoa exigua* (a parasitic organism) in the gills was also noted.
- *Gerres macracanthus*: Displays cycloid scales in both the gill and tail regions, with fin ray counts supporting its mobile, schooling behaviour.
- *Parasatromateus niger*: Also exhibits cycloid scales and a higher number of fin rays, particularly in the dorsal fin, suggesting better swimming efficiency and higher ecological fitness.
- *Pampus argenteus*: Similar to *Parasatromateus niger*, *Pampus argenteus* shows cycloid scales and high fin ray counts, indicating strong swimming capabilities and resilience in its environment.

4. Discussion

4.1 Morphometric Properties

Growth and Health Indicators: The length and weight of fish serve as significant indicators of their growth and health. *Indian Mackerel* (*Rastrelliger kanagurta*) and *Gerres* (*Gerres macracanthus*) showed good growth, with lengths of 20.3 cm and 16.3 cm, respectively, and weights of 100.37 g and 66.12 g. These growth metrics indicate healthy populations, likely due to favorable environmental conditions and adequate food availability. On the other hand, *Sole Fish* (*Solea solea*) exhibited the poorest growth with a length of 14.7 cm and weight of 14.59 g, reflecting its poor health, which may be attributed to habitat degradation or suboptimal environmental conditions. *False Trevally* (*Lacterius lacterius*) and *Silver Pomfret* (*Pampus argenteus*) also demonstrated relatively average to good growth, with corresponding weights of 45.83 g and 104.46 g, showing moderate health but not exceptional growth potential. *Black Pomfret* (*Parasatromateus niger*) demonstrated the best growth metrics, with a length of 16.0 cm and weight of 88.05 g, reflecting its very good health and likely optimal environmental conditions.

4.2 Meristic Properties

Fin Ray Counts: Fin ray counts are indicative of fish morphology and behaviour, particularly related to swimming and ecological adaptations. *Sole Fish* exhibited 65 dorsal fin rays, which is relatively high, possibly contributing to its specialized swimming capabilities in benthic environments. In comparison, *Indian Mackerel* and *Silver Pomfret* had 20 and 31 dorsal fin rays, respectively, indicative of adaptations to more pelagic environments where fast swimming and manoeuvrability are crucial for prey capture and predator avoidance. *Black Pomfret* had 37 dorsal fin rays, suggesting a need for stability and agility in its environment. Meanwhile, *Gerres* and *False Trevally* had slightly fewer dorsal fin rays, which could be linked to their specific ecological niches and swimming behaviours.

4.3 Condition Factor (K) and Health

Health Assessment: The condition factor (K) is a well-established metric for assessing the health of fish, as it reflects their body condition relative to their length and weight. *Black Pomfret* (*Parasatromateus niger*) exhibited the highest condition factor (K = 2.14), signalling very good health, which is consistent with its larger size and likely access to a rich food supply in stable environmental conditions (Smith *et al*., 2005). Similarly, *Gerres* (*Gerres macracanthus*) and *Silver Pomfret* (*Pampus argenteus*) showed good health with condition factors of 1.52 and 1.49, respectively. The condition factor of 1.19 observed in Indian Mackerel (*Rastrelliger kanagurta*) suggests healthy populations, supported by abundant resources and favourable ecological conditions.

However, the presence of the parasitic isopod *Cymothoa exigua* in mackerel negatively impacted its condition factor (K). By feeding on the fish's blood and mucus, the parasite reduced the fish's overall energy reserves, leading to a lower condition factor. This indicated poor health and a weakened physical condition, as the fish's ability to maintain optimal growth and fat reserves was compromised by the parasitic infection.

On the other hand, *Sole Fish* (*Solea solea*) had the lowest condition factor (K = 0.45), which indicates poor health, likely due to environmental stressors, resource scarcity, or habitat degradation (Weatherley & Gill, 1987). This low value may reflect insufficient fat reserves, which could negatively impact its reproductive success and survival. *False Trevally* showed an average health condition with a K value of 1.05, pointing to a moderate condition, possibly indicating some environmental challenges or competition for resources.

5. Conclusion

The study highlights the importance of morphometric and meristic analyses in assessing fish health and biodiversity. Variations in traits such as fin ray counts and condition factor emphasize the need for sustainable fisheries management. Further research is necessary to monitor environmental impacts on fish populations and explore conservation strategies for vulnerable species like *Solea solea*.

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